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Hygrocybe manadukaensis sp. nov. in section *Firmae* from Western Ghats, India

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Abstract — A new species *Hygrocybe manadukaensis*, in section *Firmae* collected from the Uppangala forest of Western Ghats of Karnataka, India is described and illustrated. Both macro- and microscopical features of the present collection are compared with similar or closely related taxa in section *Firmae*.

Key words — *Agaricales, Basidiomycota, Hygrophoraceae*, macrofungi

Introduction

Members of *Hygrocybe* (Fr.) P. Kumm. with dimorphic basidiospores and basidia in section *Firmae* are widely distributed in tropics. Corner (1936) studied this group in the paleotropics and described a new species, *Hygrophorus hypohaemactus* Corner [≡ *Hygrocybe hypohaemacta* (Corner) Pegler], and 16 new varieties of *Hygrophorus firmus* Berk. & Broome [≡ *Hygrocybe firma* (Berk. & Broome) Singer]. He also noted, however, that many of his varieties might represent species in their own right. Pegler (1983) stated that *Hygrocybe firma* represented an extremely variable species; he considered that of Corner's varieties, only *militaris* and *puniceoides* (in addition to the autonymous variety) were worthy of recognition at the species level, but he did not transfer any varieties to *Hygrocybe*. Although *Hygrocybe* species are well represented all over India (Manjula 1983, Natarajan et al. 2005), most have been described and reported from Kerala state (Leelavathy et al. 2006). However, only two species of *Hygrocybe* in section *Firmae* have been described so far from India:

H. alwisii (Berk. & Broome) Pegler from Kerala (Leelavathy et al. 2006), and *H. natarajanii* Senthil. & Kumaresan from Karnataka (Senthilarasu et al. 2010). In this study, we describe *Hygrocybe manadukaensis,* which differs macro- and microscopically from known species of *Hygrocybe* in section *Firmae*.

Materials and methods

The description and illustrations were based on the type specimen collected from Manaduka, Uppangala forest of Western Ghats of Karnataka. Handmade sections were obtained from the dried specimens, later revived in 3% KOH and mounted in 2% Phloxine. Approximately 50 basidiospores obtained from a spore print were measured. The mean spore measurements are given in parentheses followed by the range of spore measurements (with extreme values in parentheses). The type specimen was deposited in the Herbarium of Madras University Botany Laboratory (MUBL). The colour terminology used is that of Kornerup & Wanscher (1978).

Taxonomy

Hygrocybe manadukaensis Senthil., Kumaresan & S.K. Singh **sp. nov.** Figs 1, 2

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Pileus 8–25 mm diam., convexus, depressus; superficie aequabiliter aurantiacus cum flavus tinctus ad discus primus, aurantiacus ad discus, aurantiacus-rubus alibi, flavus ad margine, laevis; margine regularis, laevis, non-striatus. Lamellae subdecurrentes, luteolus ad ranunculinus, ad usque 3 mm latae, subdistantes, tribus ordinibus lamellularum intermixtae; margine concolori, laevis. Stipes 13–60 × 7–12 mm, aequalis, cylindricus, compressus ad apicem, cavus, caespitosus; superficie aequabiliter aurantiacus-rubus ad atroaurantiacus, laevis. Contextus ad usque 2 mm latae at discus, albus. Sporae dimorphae; macrosporae (12.8 ± 0.7 × 7.8 ± 0.7), (11–)11.5–13.5(–15) × 7–9(–10) µm, Q = 1.6, ellipsoideae ad late ellipsoideae, hyalinae, parietibus tenuibus, guttulis refractives; microsporae (5.5 ± 0.4 × 3.4 ± 0.2), (4.5–)5–6(–6.5) × 2.9–4 µm, Q = 1.6, ellipsoideae ad late ellipsoideae, similis ad macrosporae. Basidia dimorpha; macrobasidia 42.5–57 × 10–13 µm, cylindrico-clavata, 4-spora, sterigmatus 5.5–9.5 × 1.5–2.5 µm, parietibus tenuibus, guttulis numerosis; microbasidia 29–39 × 5.5–6.5 µm, cylindrico-clavata, 4-spora, sterigmatus ad usque 5.5 µm longus, similis ad macrobasidia. Margo lamellaris fertilis. Cystidia nulla. Trama hymenophoralis regularis, ex hyphis 1.5–7.5 µm diam. Pileal contextus ex hyphis 1.5–5 µm diam., hyalinae, parietibus tenuibus. Pileipellis cutis est ex hyphis repentibus, 1.5–7.5 µm diam. Fibulis abundantibus.

Type: India, Karnataka State, Manaduka, Uppangala Forest, 12°30'N 79°39'W, 500 masl, on ground (soil), Senthilarasu G. (**Holotype** MUBL 3429).

Etymology: This species is named for its place of collection.

Pileus 8–25 mm diam., broadly convex, soon depressed at the disc; surface uniformly deep orange (6A8), with light yellow (4A5) tints at the disc when young, light orange (5A5) at the disc, orange-red (8B8) elsewhere, deep yellow

Fig 1. *Hygrocybe manadukaensis.*
Under natural conditions in Manaduka, Uppangala forest. Photo Senthilarasu G.

(4A8) at extreme margin with age, dry, smooth; margin regular, smooth, not striate. Lamellae subdecurrent, light yellow (4A4) to butter-yellow (4A5), up to 3 mm broad, moderately close with lamellulae of 3 lengths; edge concolorous with the sides, smooth. Stipe 13–60 × 7–12 mm, equal, slightly attenuated towards apex, cylindric, slightly compressed at the apex, hollow, caespitose; surface uniformly orange-red (8B7), becoming deep orange (6A8) at maturity, often with light yellow (4A5) tints, smooth, dry. Context very thin, up to 2 mm thick at the disc, white.

Basidiospores dimorphous: macrospores (12.8 ± 0.7 × 7.8 ± 0.7) (11–) 11.5–13.5(–15) × 7–9(–10) µm, Q=1.6, ellipsoid to elongate ellipsoid, hyaline, thin-walled with few refractive guttules; microspores (5.5 ± 0.4 × 3.4 ± 0.2) (4.5–)5–6(–6.5) × 2.9–4 µm, Q=1.6, ellipsoid to elongate ellipsoid, similar to macrospores. Basidia dimorphous: macrobasidia 42.5–57 × 10–13 µm, cylindric-clavate, bearing four thick, large sterigmata, 5.5–9.5 × 1.5–2.5 µm, thin-walled, with numerous guttules; microbasidia 29–39 × 5.5–6.5 µm, cylindric-clavate, bearing four sterigmata, up to 5.5 µm long, similar to macrobasidia. Lamella-edge fertile. Cystidia absent. Hymenophoral trama regular, hyaline, of thin-walled hyphae, 1.5–7.5 µm diam., inflated to 17.5 µm diam. Subhymenial layer little developed, up to 8 µm wide, loosely interwoven. Pileal context consisting of closely interwoven, thin-walled, hyaline hyphae, 1.5–5 µm diam., inflated to 13 µm diam.; oleiferous hyphae scattered, thick-walled, 2–7 µm diam. Pileal surface a repent cutis of radially arranged parallel hyphae, 1.5–7.5 µm diam., inflated to 22.5 µm diam. Clamp-connections abundant.

Habitat - On ground, caespitose, in wet evergreen tropical forest.

Discussion: The characteristic features of *Hygrocybe manadukaensis* are the presence of deep yellow to deep orange or orange-red, smooth, convex pileus, light yellow to butter-yellow, subdecurrent lamellae, orange-red to deep orange, long and thick stipe, caespitose growth, and strongly dimorphic spores and basidia.

Among the varieties of *Hygrophorus firmus* described by Corner (1936), *Hygrocybe manadukaensis* closely resembles var. *militaris* and var. *puniceoides* in its similar sized and shaped macrospores. However, var. *militaris* clearly differs in having scarlet pileus and white stipe and var. *puniceoides* has a much larger (70–80 mm) pileus and longer (60–75 mm) stipe.

Hygrocybe manadukaensis more closely resembles *H. trinitensis* (Dennis) Pegler (Pegler 1983) in possession of a convex, shallowly depressed pileus and dimorphous basidiospores and basidia. However, *H. trinitensis* is clearly distinguished macroscopically by its small, scurfy, umblicate pileus, coral-red lamellae, and thin, scarlet stipe and microscopically by its smaller (10–13 ×

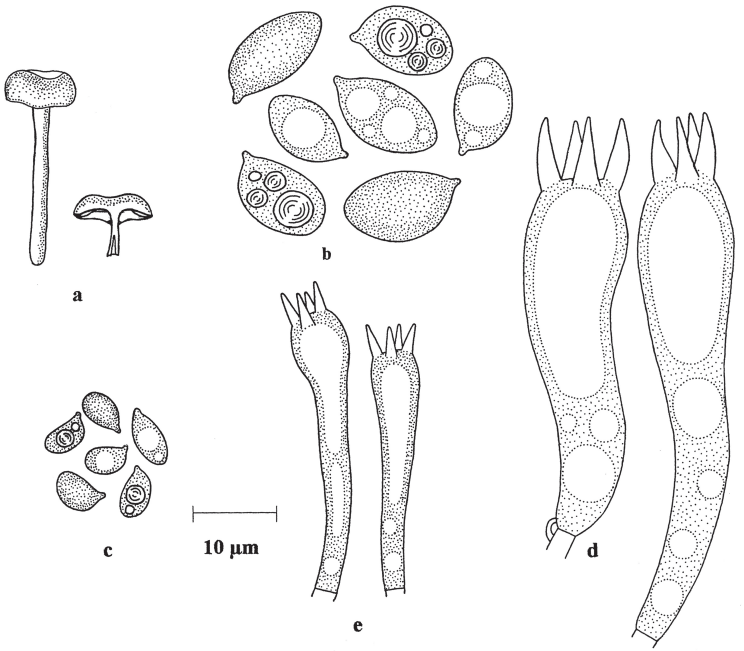

Fig 2. *Hygrocybe manadukaensis*: a. Habit ×1. b. Macrobasidiospores, c. Microbasidiospores. d. Macrobasidia. e. Microbasidia. Scale bar = 10 µm.

6–7.5 µm) macrospores, larger (7–9 × 4.5–5.5 µm) microspores, and smaller macrobasidia (35–45 × 8–9 µm) and microbasidia (20–28 µm).

Hygrocybe occidentalis (Dennis) Pegler var. *occidentalis* (Pegler 1983; Lodge & Pegler 1990) exhibits a similar range of yellow to orange colour variation and produces similarly sized macrospores and microbasidia. However, *H. occidentalis* var. *occidentalis* clearly differs macroscopically from *H. manadukaensis* in its larger (10–70 mm), convex to applanate, perforated pileus and larger (35–100 × 4–20 mm) stipe; the latter species, which possesses a convex, depressed but never perforated pileus, is differentiated microscopically by its smaller microspores (5–8 × 3.3–5 µm in *H. occidentalis* var. *occidentalis*). In addition, both species differ in their growth habit, where *H. manadukaensis* produces caespitose basidiomes in contrast to the solitary to scattered habit of *H. occidentalis* var. *occidentalis*.

Hygrocybe anisa (Berk. & Broome) Pegler (Pegler 1986) produces similarly coloured and sized, caespitose basidiomes, macrospores, and microbasidia. However, *H. anisa* differs macroscopically from *H. manadukaensis* in its

straw yellow, slightly floccose/squamose pileus that lacks the orange tints that characterize *H. manadukaensis* and slender (2–5 mm) stipe. In addition, *H. anisa* is distinguished microscopically by larger microspores (6.5–8 × 4.5–5.3 µm) and macrobasidia (60–70 µm).

While the dimensions of the macro- and microspores of *H. natarajanii* are similar to those of *H. manadukaensis*, *H. natarajanii* has a yellow pileus covered with ruby red, tomentose squamules and a light yellow, longer, slender (50–140 × 2–5 mm) stipe. In addition, *H. natarajanii* has larger macro- (55 – 68.5 µm) and micro- (37–44.5 µm) basidia (Senthilarasu et al. 2010).

Hygrocybe manadukaensis somewhat resembles *H. firma* (Berk. & Broome) Singer (Pegler 1986) in the orange to pale yellow convex pileus, subdecurrent pale yellow lamellae, long, thick, orange to pale yellow stipe, and similarly sized macrospores and microbasidia. However, *H. firma* clearly differs macroscopically in its tomentose to scurfy squamulose/fibrillose, perforated pileus, contrasting with the non-perforated smooth pileus of *H. manadukaensis*. In addition, *H. firma* microscopically differs in its larger microspores (6–8 × 4.5–6 µm) and macrobasidia (50–75 × 12–16 µm).

The morphological variation observed in the specimen from Manaduka differentiates it from the above taxa and supports it as a new species in section *Firmae*.

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Literature cited

Corner EJH. 1936. *Hygrophorus* with dimorphous basidiospores. Transactions of the British Mycological Society 20: 157–184. doi:10.1016/S0007-1536(36)80008-4

Kornerup A, Wanscher JH. 1978. Methuen Handbook of Colour. 3rd edn. Methuen and Co., Ltd., London. 243 p.

Leelavathy KM, Manimohan P, Arnolds EJM. 2006. *Hygrocybe* in Kerala State, India. Persoonia 19: 101–151.

Lodge DJ, Pegler DN. 1990. *Hygrophoraceae* of the Luquillo Mountains of Puerto Rico. Mycological Research 94(4): 443–456. doi:10.1016/S0953-7562(10)80002-4

Manjula B. 1983. A revised list of the agaricoid and boletoid basidiomycetes from India and Nepal. Proceedings of Indian Academy of Sciences (Plant Science) 92: 81–213.

Natarajan K, Kumaresan V, Narayanan K. 2005. A checklist of Indian agarics and boletes (1984–2002). Kavaka 33: 61–128.

Pegler DN. 1983. Agaric flora of the Lesser Antilles. Kew Bulletin Additional Series IX.

Pegler DN. 1986. Agaric flora of Sri Lanka. Kew Bulletin Additional Series XII.

Senthilarasu G, Kumaresan V, Singh SK. 2010. A new species of *Hygrocybe* in section *Firmae* from Western Ghats of India. Mycotaxon 111: 301–307.